

## **A. Project Information**

**Final report:** 8/1/13 – 6/30/16

**Project Title:** Nitrogen Management Training for Certified Crop Advisors

**Agreement Number:** 13-0241-SA

### **Project Leaders:**

|  |  |   |
|--|--|---|
| Doug Parker, Director<br>California Institute for Water Resources<br>University of California<br>1111 Franklin Street<br>Oakland, CA 94607<br>510-987-0036<br>Doug.parker@ucop.edu | Patrick Brown, Professor<br>Dept of Plant Sciences<br>University of California<br>Davis, CA 95616<br>530-752-0929<br>phbrown@ucdavis.edu | Allan Fulton, Advisor<br>Coop. Ext. Tehama County<br>1754 Walnut Street<br>Red Bluff, CA 96080<br>530-527-3101<br>aefulton@ucanr.edu                          |
| Tim Hartz, Specialist<br>Dept of Plant Sciences<br>University of California<br>103 Asmundson Hall<br>Davis, CA 95616<br>530-752-1738<br>tkhartz@ucdavis.edu                        | Dan Munk, Advisor<br>Coop. Ext. Fresno County<br>550 E. Shaw Avenue, Ste 210<br>Fresno, CA 93710<br>559-241-7515<br>dsmunk@ucanr.edu     | Daniel Geisseler, Specialist<br>Dept of Land, Air & Water Resources<br>University of California<br>Davis, CA 95616<br>530-754-9637<br>djgeisseler@ucdavis.edu |

## **B. Objective:**

The objective of this program was to facilitate California's Certified Crop Advisors understanding of sound nitrogen management practices and increase their ability to make informed recommendations to growers, thereby improving environmental performance relative to nitrogen management for crop production.

## **C. Abstract:**

The University of California, Division of Agriculture and Natural Resources, with support from the California Department of Food and Agriculture's Fertilizer Research and Education Program, developed a training program aimed at helping growers to develop efficient nitrogen management practices. The training was offered in 2014, 2015, and 2016 to Certified Crop Advisers (CCAs) through the California Association of Pest Control Advisers, in locations around the state. Over 800 CCAs have been trained to date, and evaluations show that participants increased their understanding of nitrogen management, the nitrogen cycle in crop production, and nitrogen budgeting.

#### **D. Introduction:**

The Nitrogen Management Training and Certification Program was a joint effort between the California Department of Food and Agriculture; University of California, Agricultural and Natural Resources; California Certified Crop Advisor Program of the California Association of Pest Control Advisors; and the Regional Water Boards to develop and implement a voluntary nitrogen management curriculum specifically targeted for California Certified Crop Advisors. The effort was coordinated by the University of California's California Institute for Water Resources. The curriculum addressed the management of nitrates to reduce unintentional emissions in waters throughout the state.

#### **E. Work Description:**

This project involved curriculum development, website development and maintenance, trainings, and publications. The project was carried out in two phases with deliverables provided in stages.

#### **Phase I: (August 1, 2013 – December 31, 2014)**

This phase involved curriculum development and an initial round of trainings.

**Curriculum Development.** The initial curriculum was developed by small teams (5-15 people). A team leader organized each team. Participants were involved in curriculum development with in-person meetings and virtual collaboration.

**Trainings Sessions.** The course was developed to be one and a half days in length. Team members led training sessions. Logistics for the training sessions were provided by the California Association of Pest Control Advisors. The dates and locations for the first set of trainings took place as follows:

1. Modesto – January 14-15, 2014
2. Woodland – February 18-19, 2014
3. Fresno – February 25-26, 2014
4. Salinas – March 5-6, 2014
5. Tulare – March 11-12, 2014

**Website Development.** A website was developed at [ciwr.ucanr.edu/nitrogenmanagement](http://ciwr.ucanr.edu/nitrogenmanagement). Presentations from the training sessions are available and were updated to make the annotated versions of the presentations available. Video of presentations are also available.

#### **Phase II: (October 1, 2014 – June 30, 2016)**

This phase involved curriculum modification based on what was learned during the first set of trainings, a second round of trainings, and development of publications and other outputs from the curriculum that can be used for additional outreach.

**Curriculum Modification.** The curriculum used in the first round of trainings was reviewed based upon feedback from evaluations during those trainings. Modifications to the curriculum were implemented.

**Training Sessions.** Three additional training sessions were held in early 2015 and 2016 as follows:

1. Fresno – January 13-14, 2015
2. San Luis Obispo – February 24-25, 2015
3. Sacramento – March 10-11, 2015
4. Fresno – January 20-21, 2016

**Publications.** A total of 11 publications (see list below) were drafted from the training materials, lessons learned from the training sessions, and from additional research. They will be finished under a subsequent contract. The topics are as follows:

1. Nitrogen cycle principles, fertilizer management, nitrogen budgeting
2. Irrigation and nitrogen management
3. Cole crops and leafy greens
4. Wheat
5. Corn – silage and grain
6. Strawberry and cane berries
7. Tomatoes and melons
8. Cotton
9. Nuts
10. Citrus and avocados
11. Deciduous fruits and grapes

## **F. Data/Results:**

The curriculum for the trainings was developed as follows:

### **Day 1: Nutrient Management**

- |          |   |
|----------|---|
| 9:00 am  | Module 1: Objectives                                |
| 9:30 am  | Module 2: Nitrogen Cycle in Crop Production Systems |
| 11:15 am | Module 3: Nitrogen Sources                          |
| 1:00 pm  | Module 4: Irrigation and Nitrogen Management        |
| 2:00 pm  | Module 5: Nitrogen Budgeting                        |
| 3:00 pm  | Module 6: Tools and Resources                       |
| 3:45 pm  | Regional Board Update                               |
| 4:30 pm  | Questions/summary/check-out                         |

### **Day 2: Annual and Permanent Crops** (participants chose a crop type track)

- |          |                                       |
|----------|---------------------------------------|
| 8:00 am  | Current practices and BMPs            |
| 10:30 am | Nitrogen management planning exercise |



Figure 1. Doug Parker, director of the California Institute for Water Resources, and Terry Stark, executive director of the California Association of Pest Control Advisers.



Figure 2. Participants at the first nitrogen training event in Modesto.



Figure 3. Dr. Tim Hartz presents module 3. Photo courtesy of Steve Beckley.

At this time, training materials and videos are available on the web at [ciwr.ucanr.edu/nitrogenmanagement](http://ciwr.ucanr.edu/nitrogenmanagement). We developed fully updated, annotated presentations for the curriculum to make the material more accessible for participants across trainings.

## G. Discussion and Conclusions:

The objective of this program was to facilitate CCAs understanding of sound nitrogen management practices and increase their ability to make informed recommendations to growers, thereby improving environmental performance relative to nitrogen management for crop production. After each training session, participants were asked to evaluate their understanding of nitrogen management before and after the training. The results were compiled as follows:

### A.) My overall understanding of nitrogen management.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 6%     | 0%         |
| Moderate | 34%    | 4%         |
| Good     | 51%    | <b>53%</b> |
| Complete | 9%     | <b>42%</b> |

### B.) My understanding of the nitrogen cycle in crop production.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 3%     | 0%         |
| Moderate | 23%    | 3%         |
| Good     | 58%    | <b>51%</b> |
| Complete | 16%    | <b>46%</b> |

C.) My understanding of nitrogen sources in crop production.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 3%     | 0%         |
| Moderate | 18%    | 3%         |
| Good     | 58%    | <b>52%</b> |
| Complete | 21%    | <b>45%</b> |

D.) My understanding of irrigation management and its relationship to nitrogen fertilization.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 3%     | 0%         |
| Moderate | 27%    | 3%         |
| Good     | 45%    | <b>48%</b> |
| Complete | 24%    | <b>49%</b> |

E.) My understanding of the process of nitrogen budgeting.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 17%    | 1%         |
| Moderate | 38%    | 7%         |
| Good     | 34%    | <b>56%</b> |
| Complete | 11%    | <b>37%</b> |

F.) My understanding of nitrogen management tools and resources.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 20%    | 0%         |
| Moderate | 42%    | 8%         |
| Good     | 36%    | <b>54%</b> |
| Complete | 3%     | <b>34%</b> |

G.) My understanding of nitrogen management in annual or permanent crops.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 10%    | 1%         |
| Moderate | 31%    | 12%        |
| Good     | 52%    | <b>53%</b> |
| Complete | 7%     | <b>34%</b> |

H.) My capacity to advise in the development of a nitrogen management approach.

|          | Before | After      |
|----------|--------|------------|
| Slight   | 16%    | 2%         |
| Moderate | 37%    | 10%        |
| Good     | 41%    | <b>47%</b> |
| Complete | 6%     | <b>41%</b> |

In general, across all categories, the percentage of participants with slight to moderate understanding of nitrogen management before the training was reduced as the percentage of participants with good to complete understanding increased after the training. In addition, 95%

of participants found the presenters very knowledgeable and informative, and found many parts of the training helpful. Most importantly, most participants felt they were better prepared to address nitrogen mitigation regulatory requirements after the training.

## **H. Project Impacts:**

The following table summarizes the reach of the training program in numbers of Certified Crop Advisers that participated:

| <b>Training Date</b> | <b>Location</b> | <b>Completed</b> | <b>No Shows</b> | <b>Partial Hours</b> | <b>Total Registered</b> |
|----------------------|-----------------|------------------|-----------------|----------------------|-------------------------|
| 1/14/14 – 1/15/14    | Modesto         | 113              | 0               | 0                    | 113                     |
| 2/18/14 – 2/19/14    | Woodland        | 89               | 1               | 0                    | 90                      |
| 2/25/14 – 2/26/14    | Fresno          | 111              | 4               | 1                    | 116                     |
| 3/05/14 – 3/06/14    | Salinas         | 104              | 0               | 3                    | 107                     |
| 3/11/14 – 3/12/14    | Tulare          | 112              | 7               | 4                    | 123                     |
| 1/13/15-1/14/15      | Fresno          | 67               | 4               | 3                    | 75                      |
| 2/24/15-2/25/15      | San Luis Obispo | 68               | 0               | 7                    | 76                      |
| 3/10/15-3/11/15      | Sacramento      | 74               | 5               | 4                    | 94                      |
| 1/20/16-1/21/16      | Fresno          | 68               | 4               | 0                    | 93                      |
|                      | <b>TOTALS</b>   | <b>806</b>       | <b>25</b>       | <b>22</b>            | <b>887</b>              |

The 806 newly trained certified crop advisors have increased their knowledge and skills in making fertilizer use recommendations. This should lead to increased fertilizer use efficiency and increased profits to growers. Actual changes in fertilizer recommendations were not measured as part of this project.

## **I. Outreach Activities Summary:**

The results of this project are a series of trainings for Certified Crop Advisers. The training and outreach activities are detailed above.

## **J. Factsheet/Database Template:**

**1. Project Title:** Nitrogen Management Training for Certified Crop Advisors

**2. Agreement Number:** 13-0241-SA

### **3. Project Leaders:**

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|---|--|---|
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**4. Start Year/End Year:** 2013/2016

**5. Location:** Statewide

**6. County:** Statewide

### **7. Highlights:**

- The objective of this program was to facilitate California's Certified Crop Advisors (CCAs) understanding of sound nitrogen management practices and increase their ability to make informed recommendations to growers, thereby improving environmental performance relative to nitrogen management for crop production.
- A training curriculum was developed and training sessions were offered in 2014, 2015, and 2016 through the California Association of Pest Control Advisers around the state.
- Over to 800 CCAs have been trained to date. Evaluations show that participants increased their understanding of nitrogen management, the nitrogen cycle in crop production, and nitrogen budgeting. All materials are now available on the web.

### **8. Introduction:**

In 2012, the report "Addressing Nitrate in California's Drinking Water" was released by University of California, Davis researchers after being commissioned by the California State Water Resources Control Board. The researchers reported that one in 10 people living in some of



California's most productive agricultural areas is at risk of exposure to harmful levels of nitrate in their drinking water.

One key findings of the report was that 90 percent of the nitrate leached to groundwater came from agricultural fertilizers and animal manure applied to cropland. The report also noted reducing nitrate in groundwater is possible through improved fertilizer and water management.

The California Department of Food and Agriculture's Fertilizer Research and Education Program approached the University of California Agriculture and Natural Resources, which has a long history working on nitrogen issues, to develop a training program helping California's Certified Crop Advisers optimize nitrogen management practices.

## **8. Methods/Management:**

The Nitrogen Management Training and Certification Program was a joint effort between the California Department of Food and Agriculture; University of California, Agricultural and Natural Resources; California Certified Crop Advisor Program of the California Association of Pest Control Advisors; and the Regional Water Boards to develop and implement a voluntary nitrogen management curriculum specifically targeted for California Certified Crop Advisors. The effort was coordinated by the University of California's California Institute for Water Resources. The curriculum addressed the management of nitrates to reduce unintentional emissions in waters throughout the state.

The training curriculum was developed by a core group of UC faculty and cooperative extension specialists and advisors. The training focused broadly on nitrogen management, and included modules on the nitrogen cycle and nitrogen sources in crop production, such as irrigation water. Nine training sessions were offered between 2014 and 2016 around the state, with over to 800 CCAs trained.

## **9. Findings**

The objective of this program was to facilitate CCAs understanding of sound nitrogen management practices and increase their ability to make informed recommendations to growers, thereby improving environmental performance relative to nitrogen management for crop production. After each training session, participants were asked to evaluate their understanding of nitrogen management before and after the training.

The percentage of participants with slight to moderate understanding of nitrogen management before the training was reduced as the percentage of participants with good to complete understanding increased after the training. Ninety-five percent of participants found the presenters very knowledgeable and informative, and found many parts of the training helpful. Most importantly, most participants felt they were better prepared to address nitrogen mitigation regulatory requirements after the training.

**K. Copy of the Product/Result:**

All of the training materials and videos from the trainings can be found on our website:  
<http://ciwr.ucanr.edu/nitrogenmanagement/>.